4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

4.1 GEOLOGY AND SOILS

This section includes discussions of impacts and mitigation measures related to geology and soils in the study area and will focus primarily on the identified Preferred Alternative, (Enhanced) Reduced Build Alternative.

The analyses in this section were the result of refined engineering and/or additional planning efforts. As discussed in Section 2.2-1, the added limits to the (Enhanced) Reduced Build Alternative would not contribute to any new environmental impacts. Potential environmental impacts from this added portion have been previously analyzed as part of the Full Build Alternative (SR-22/SR-55 HOV connector) and determined not to be substantial to geology and soils. The comments and responses to comments are attached as Appendix A of this FEIS/EIR (Volumes II & III).

4.1.1 TOPOGRAPHY

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would not appreciably change the topography within the study area. Proposed improvements would extend the freeway cross-section and the start of slopes an average distance of 5.5 meters (18 feet) on each side, with retaining walls of varying heights added where needed. Topographical changes would be minimal.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

   The No Build Alternative would not result in construction of new transportation facilities other than those addressed in previous environmental documents; therefore, no impacts to topography would occur.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

   The TSM/Expanded Bus Service Alternative would not result in construction of new transportation facilities that would alter topography. Therefore, negligible impacts, if any, to topography would occur.

3. FULL BUILD ALTERNATIVE

   The Full Build Alternative would not appreciably change the topography within the study area. The largest topographical change that would result under the Full Build Alternative is the new Pacific Electric Arterial and its interchange with SR-22. This new element would require structures and retained fill for the portion of the arterial/interchange that is elevated.

Thresholds of Significance for CEQA:

- Potential to substantially alter the configuration of the topography including its relief and the position of its natural and man made features

CEQA Findings:

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would not appreciably alter the topography within the study area. New fill would be required mainly for widening of existing roadways or realignment of existing interchanges. In order to reduce right-of-way impacts, some fill would be retained with walls. Change to topography would be minimal. All changes would be designed in accordance with standard engineering practices and the Department specifications. These changes would result in less than significant impacts.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

The No Build Alternative would have no impact.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would have no impact.

3. FULL BUILD ALTERNATIVE

The Full Build Alternative would not appreciably alter the topography within the study area. The largest topographical change that would result under the Full Build Alternative is the new Pacific Electric Arterial and its interchange with SR-22.

4.1.2 SEISMICITY

The study area may traverse the active Newport-Inglewood fault zone in the area of the I-405/SR-22 and I-405/I-605 interchanges, the exact location of which has not been identified. There are several seismic hazards that could affect this area, including ground acceleration or ground shaking, surface or fault rupture and liquefaction (Section 4.1.3). However, all design elements for the proposed project would adhere to special guidelines with construction activities in seismically active regions as set forth in the Highway Design Manual. Seismic activity is a key element that would be fully addressed during the design phase.

Ground shaking occurs at the earth's surface as a result of a release of energy during an earthquake. A vibrating or seismic wave generates from the source of the earthquake, much like the waves created when a rock is tossed into a pool of water. Generally, the closer the source of the seismic event, the more the ground shakes. Areas in close proximity to the I-405/SR-22 and I-405/I-605 interchanges would be most susceptible to the effects of ground shaking. Areas further from this area would be less affected.

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Not all earthquakes result in surface rupture. Fault rupture almost always follows pre-existing faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. It is impossible to predict whether a surface rupture would occur during a seismic event in the Newport-Inglewood fault zone.

Other faults in the area could produce earthquakes that could damage the structures in the study area and result in injury or death. This condition is prevalent throughout California and is not unique to the study area.

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would include improvements in the assumed vicinity of the active Newport-Inglewood fault zone in the area of the I-405/SR-22 and I-405/I-605 interchanges. Thus it could expose people to hazards described above. It should be noted, however, that the project would include only widening of an existing facility in this area; therefore, it would not expose people to a new hazard.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

The No Build Alternative would not result in construction of new transportation facilities other than those addressed in other environmental documents. Therefore, it would not pose additional seismic hazards beyond what currently exists in the study area.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would not include any capital improvements to SR-22. Therefore, it would not pose additional seismic hazards beyond what currently exists in the study area.

3. FULL BUILD ALTERNATIVE

The Full Build Alternative would include improvements in the assumed vicinity of the active Newport-Inglewood fault zone in the area of the I-405/SR-22 and I-405/I-605 interchanges, and may expose people to seismic hazards. However, the project would include only widening of an existing facility in this area and would not expose people to a new hazard.

Thresholds of Significance for CEQA:

- Potential for seismic hazards and ground shaking activities

CEQA Findings:

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would also include improvements in the assumed vicinity of the active Newport-Inglewood fault zone. This would result in less than significant impacts to seismic hazards and ground shaking activities since the proposed project involves widening of an existing facility.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

The No Build Alternative would have no impact on seismic hazards and ground shaking activities.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would have no impact on additional seismic hazards and ground-shaking activities beyond what currently exists in the study area.

3. FULL BUILD ALTERNATIVE

The Full Build Alternative would include improvements in the assumed vicinity of the active Newport-Inglewood fault zone. The project would include only widening of an existing facility in this area; it would not expose people to a new hazard. This would result in less than significant impacts to seismic hazards and ground shaking activities.

4.1.3 LIQUEFACTION

There is a moderate to high susceptibility of liquefaction within the study area due to a high water table. Adverse effects of liquefaction can take many forms, including flow failures, lateral spreads, ground oscillation, loss of bearing strength, settlement and increased lateral pressure on retaining walls (EERI, 1994). The most serious of these, flow failures, may displace large masses of soil laterally, sometimes over great distances. Because these types of failures generally occur on steep slopes, however, they are unlikely to affect the project study area. Lateral spreads, which involve lateral displacement of blocks of soil as a result of liquefaction at the subsurface, generally develop on gentle slopes and are therefore more likely to occur within the study area.

When the soil supporting a building or other structure liquefies and loses strength, large deformations can occur within the soil that may allow the structure to settle and tip. Conversely, buried tanks and piles may rise buoyantly through the liquefied soil. This is a secondary effect of liquefaction and there is a high potential for this type of failure in the study area.

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

Structures and pavements associated with the (Enhanced) Reduced Build Alternative would be susceptible to the types of failures discussed above, including lateral spreads, ground oscillation, loss of bearing strength, settlement and increased lateral pressure on retaining walls. However, all design elements for the proposed project would adhere to special guidelines with construction activities in seismically active regions as set forth in the Highway Design Manual.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

Since no construction is associated with the No Build Alternative aside from that discussed in previous environmental documents, no additional impacts related to liquefaction are anticipated.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would include operational improvements and would not include any capital improvements to SR-22. Therefore, new exposure to liquefaction hazards would be negligible.

3. FULL BUILD ALTERNATIVE

Structures and pavements associated with the Full Build Alternative would be susceptible to the types of failures discussed above, including lateral spreads, ground oscillation, loss of bearing strength, settlement and increased lateral pressure on retaining walls.

Thresholds of Significance for CEQA:

- Potential for liquefaction activities

CEQA Findings:

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would be subject to the types of failures discussed above. Soil would be stabilized under this Alternative to minimize the potential for liquefaction or to control its effect, resulting in less than significant impacts.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

The No Build Alternative would not result in significant impacts related to liquefaction.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would not result in significant impacts on new exposure to liquefaction hazards.

3. FULL BUILD ALTERNATIVE

Structures and pavements associated with the Full Build Alternative would be susceptible to the types of failures discussed above, including lateral spreads, ground oscillation, loss of bearing strength, settlement and increased lateral pressure on retaining walls. Soil would be stabilized under this Alternative to minimize the potential for liquefaction or to control its effect, resulting in less than significant impacts.

4.1.4 EXPANSIVE SOILS

Expansive soils contain clay minerals, which will swell when wetted to as much as 1.5 to 2.0 times their original dry volume. If construction takes place on wet materials that have high shrink-swell potential, and these materials subsequently are drained and dried, the resulting shrinkage may cause severe cracking in structures. Saturation of soil from rainfall, irrigation, groundwater or leaking pipes may cause major damage through the expansion of soils beneath highways, utility lines and foundations. Please refer to Table 2.2-1, (Enhanced) Reduced Build Alternative Elements.

Expansive soils are found throughout the study area.

A. PREFFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

Structures and pavements associated with the (Enhanced) Reduced Build Alternative would be subject to the failures associated with expansive soils described above, unless appropriate measures are taken. The exposure to these hazards would be less than under the Full Build Alternative.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

Because no construction is associated with the No Build Alternative, aside from that discussed in previous environmental documents, no additional impacts related to expansive soils are anticipated.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would not include any capital improvements to SR-22. Therefore, new failures associated with expansive soils as described above would not be of concern.

3. FULL BUILD ALTERNATIVE

Structures and pavements associated with the Full Build Alternative would be subject to the failures associated with expansive soils described above, unless appropriate measures are taken.

Thresholds of Significance for CEQA:

- Potential for expansive soils

CEQA Findings:

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

Structures and pavements associated with the (Enhanced) Reduced Build Alternative would be subject to the failures associated with expansive soils previously discussed, unless appropriate measures are taken. These may include replacement of soil, treatment with lime, or supporting of structures on deep foundation, which would take place during the construction phase. The exposure to these hazards would be less than significant.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

No impacts related to expansive soils are anticipated as a result of the No Build Alternative.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

The TSM/Expanded Bus Service Alternative would not result in significant impacts related to expansive soils.

3. FULL BUILD ALTERNATIVE

Structures and pavements associated with the Full Build Alternative would be subject to the failures associated with expansive soils described above, unless appropriate measures are taken, resulting in less than significant impacts.

4.1.5 EROSION

A. PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would require the disturbance of soil and sediments in upland areas and in riverbeds during construction. Grading would occur in upland areas and new

piers would be installed in riverbeds. Consequently, the potential exists for disturbed soil to erode and for sediments to be transported by water.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

Since no construction is associated with the No Build Alternative, aside from that discussed in previous environmental documents, no additional impacts related to erosion are anticipated.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

Only operational improvements and minor construction are included in the TSM/Expanded Bus Service Alternative; therefore, negligible impacts related to erosion are anticipated.

3. FULL BUILD ALTERNATIVE

The Full Build Alternative would require the disturbance of soil and sediments in upland areas and in riverbeds during construction. Grading would occur in upland areas and new piers would be installed in riverbeds. Consequently, the potential exists for disturbed soil to erode and for sediments to be transported by water.

Thresholds of Significance for CEQA:

- The potential for substantial disturbance of soil causing erosion, disturbance of soil in riverbeds, soil erosion during excavation, and the redesigning of drainage which may result in slope erosion

CEQA Findings:

A. PREFFERED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

The (Enhanced) Reduced Build Alternative would result in less than significant impacts if appropriate erosion-control measures are taken.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

No additional impacts related to the above erosions are anticipated under the No Build Alternative.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

No impacts related to the above-discussed erosions are anticipated with this alternative.

3. FULL BUILD ALTERNATIVE

The Full Build Alternative would result in less than significant impacts if appropriate erosion-control measures are taken.

4.1.6 MITIGATION

A. PREFFERED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

GEO-(E)RB-1. Structures will be designed to resist the maximum credible earthquake associated with nearby faults without endangering human life through collapse. To minimize potential structural damage due to seismically induced ground shaking, the following design measures will be utilized as needed:

- Hinge restrainers to hold together superstructure elements during extreme motion
- Heavy keys to limit movement between the superstructure and abutment
- Increased reinforcement in column sections to assure effective confinement of concrete allowing large movements to occur without collapse

GEO-(E)RB-2. Detailed geotechnical studies will be performed for areas that will support pavement or foundations in conjunction with detailed engineering design to provide appropriate boring, soil and fault information. This information will be used to minimize potential adverse impacts. The following items will be addressed:

- Precise location of areas of potential liquefaction
- Borings to determine the depth and geometry of alluvium and deeper soil types and to sample materials for various laboratory analyses
- Establishment of engineering criteria for ground acceleration to be used for the design of corridor structures and facilities in accordance with the Department's guidelines

All areas of historically high or perched groundwater levels will be analyzed in detail during project design to verify the potential for liquefaction. Should soils subject to liquefaction be found, site-specific engineering techniques (e.g. importation of stable material, compaction of soils, permanent de-watering and attachment of deep-set piles to bedrock or lower, denser soils) will be implemented.

GEO-(E)RB -3. Small structures will be strengthened to resist predicted ground movements.

GEO-(E)RB -4. Appropriate foundation types and depths will be designed (including foundation modifications in the case of existing structures) so that ground movements will not adversely affect the structure. For example, deep piles or piers that extend below the zone of liquefiable soil may be used.

GEO-(E)RB -5. Soil will be stabilized to eliminate the potential for liquefaction or to control its effects (e.g., removal and replacement of liquefiable soils; in situ stabilization by grouting, densification, or de-watering; buttressing of lateral spread zones).

GEO-(E)RB -6. During final engineering design, the area and thickness of expansive soils will be evaluated. Measures that mitigate for expansive soils will be incorporated into the construction documents. These measures may include replacement of soil, treatment with lime, or supporting of structures on deep foundations.

GEO-(E)RB -7. Appropriate erosion-control measures will be incorporated into the construction documents and implemented during site preparation, grading and construction. These measures may include protecting exposed slope areas, control of surface flows over exposed soils, use of wetting or sealing agents and/or sedimentation ponds, and limiting soil excavation in high winds.

GEO-(E)RB -8. Excess excavated soil will be hauled away from the job site and disposed of at an appropriate, permitted disposal facility. The contractor will be responsible for ensuring that the soil is hauled away on an approved route to a permitted disposal facility.

GEO-(E)RB -9. To avoid transport of sediments during construction, work within riverbeds will not occur when water is present. If necessary, cofferdams may be used to keep water out of the construction area.

GEO-(E)RB -10. Roadway and bridge deck drainage will outlet under the bridge abutments onto energy dissipaters to prevent slope erosion.

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

None proposed.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

None proposed.

3. FULL BUILD ALTERNATIVE

Mitigation measures GEO-(E)RB-1 through GEO-(E)RB-10 for the (Enhanced) Reduced Build Alternative are the same for the Full Build Alternative.

4.1.7 RESIDUAL IMPACTS AFTER MITIGATION

A IDENTIFIED PREFERRED ALTERNATIVE/(ENHANCED) REDUCED BUILD ALTERNATIVE

Through mitigation, impacts related to liquefaction and expansive soils would be prevented. All other impacts would be minimal after mitigation

B. OTHER ALTERNATIVES

1. NO BUILD ALTERNATIVE

None.

2. TSM/EXPANDED BUS SERVICE ALTERNATIVE

None.

3. FULL BUILD ALTERNATIVE

Through mitigation, impacts related to liquefaction and expansive soils would be prevented. All other impacts would be minimal after mitigation.

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